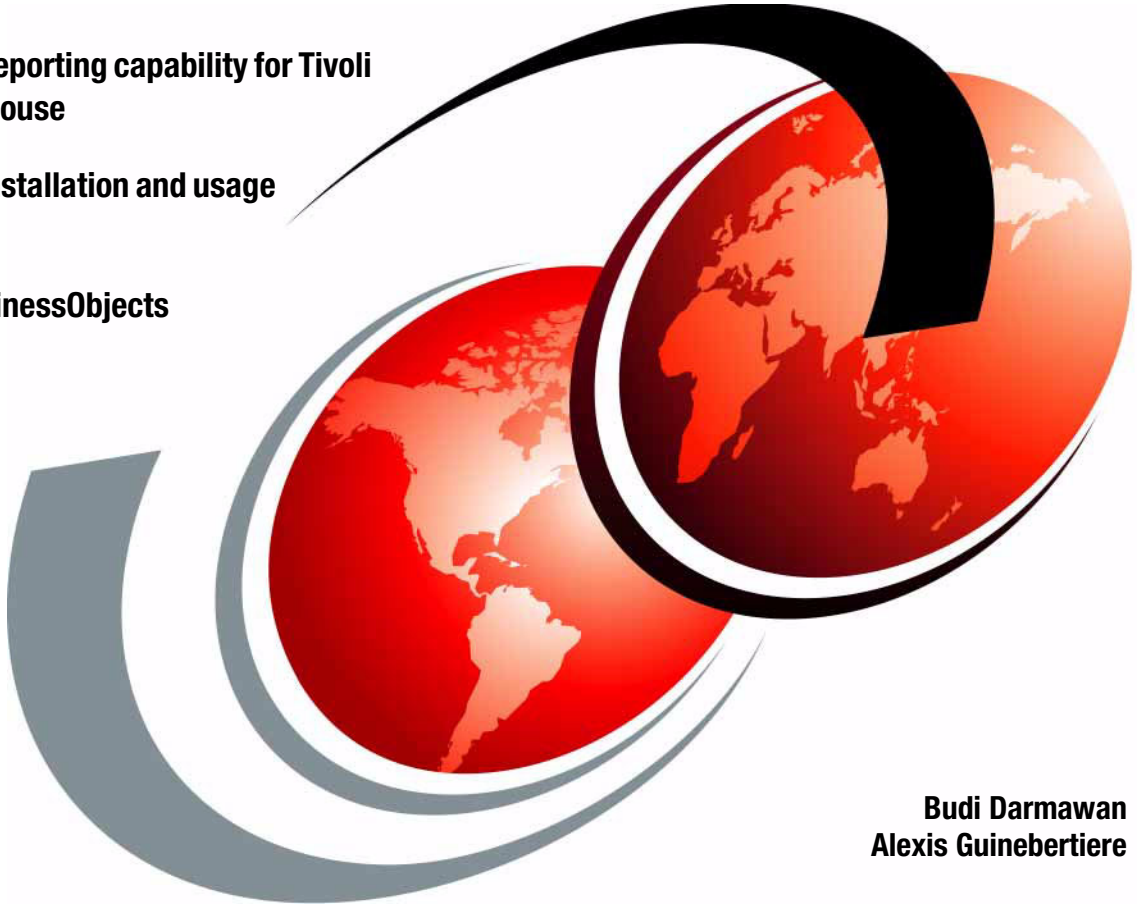
Tivoli software

IBM

Tivoli Data Warehouse 1.2 and BusinessObjects

- Advanced reporting capability for Tivoli Data Warehouse
- Complete installation and usage examples
- Covers BusinessObjects



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Redpaper

International Technical Support Organization

Tivoli Data Warehouse 1.2 and BusinessObjects

June 2004

Note: Before using this information and the product it supports, read the information in “Notices” on page v.

First Edition (June 2004)

This edition applies to Tivoli Data Warehouse Version 1.2 and BusinessObjects.

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Preface

This IBM® Redpaper will guide you on using various reporting tools that are available in the market to work with the data you collect with Tivoli Data Warehouse. The collected data resides on a DB2® database with the form or star schema. The basic Tivoli Data Warehouse product comes with an integrated reporting tool. However, the reports provided with the product may not be sufficient for all your reporting needs. You may want to expand the reporting capability of the Tivoli Data Warehouse with vendor reporting tools.

This Redpaper discusses the reporting tools of the Business Objects® company that can be used with the Tivoli Data Warehouse data. Business Objects is a leading business intelligence software company.

The discussion of each vendor reporting tool should not be considered to replace the respective vendor product manual. The examples provided in this Redpaper serve as a quick reference for starting to use Business Objects' reporting tools.

Note: You will see throughout this document both the terms Business Objects (two words with a space separating them), and BusinessObjects™ (one word). Business Objects (two words) is the company name. BusinessObjects (one word) is the product name.

The team that wrote this Redpaper

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1

Introduction to Tivoli Data Warehouse report integration

This chapter introduces the concept and content of this Redpaper. The discussion is divided into:

- 1.1, “Business intelligence concepts” on page 2
- 1.2, “Tivoli Data Warehouse” on page 3
- 1.3, “Report generation” on page 5
- 1.4, “Reporting tools” on page 7

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1.1 Business intelligence concepts

Tivoli Data Warehouse (TDW) provides data warehousing capability for IBM Tivoli products to store its data, provide historical information, and generate reports. These features are based on IBM DB2 Universal Database™ business intelligence capability.

In this section, we discuss the basic concept of data warehousing that is necessary to understand the Tivoli Data Warehouse. The basic ideas of business intelligence are:

- Data from various sources needs to be consolidated into a central location. This location is typically called a data warehouse. The centralized approach is preferable because it provides the opportunity to perform data correlation, enrichment, and standardization.
- Reporting of collected data is performed using a specialized database that is optimized for reporting called a data mart. This database is constructed from the information from the data warehouse. The data warehouse then becomes the master database, while each reporting function uses a specific data mart optimized for its own purpose.

The following terms are helpful in understanding business intelligence:

Data warehouse	A collection of data from various sources that acts as the master copy of information
Data mart	A specialized database for a specific reporting purpose
ETL process	Extract, transform, load - indicates how data should be processed into the data warehouse or data mart
Metadata	Additional information that is not directly related to the measurement values but is used in the building of the data by the ETL process and other reporting tools
Star schema	A typical data mart structure consisting of one table in the middle connected to various tables in a star-like formation
Fact table	The central table of a star schema, containing all the measurement values of the reported object
Dimension table	A table containing the hierarchical attributes (from general to detailed) that can be applied to values in the fact table
OLAP cube	Online analytical process that converts the star schema into a prepopulated, multidimensional cube for faster reports generation with huge amounts of data
Drill-down	The action of getting more detailed information for a specific dimension

Slice and dice	The action of retrieving other dimension data or moving from one view to another in the same dimension to get more meaningful information
Data mining	An automated process to determine trends and correlations of various data components

We discuss more on the star schema structure in 1.3, “Report generation” on page 5.

1.2 Tivoli Data Warehouse

The Tivoli Data Warehouse collects data from various IBM Tivoli products and puts them in a consolidated central data warehouse. Each IBM Tivoli product provides a set of warehouse enablement packs to interface with the Tivoli Data Warehouse.

The warehouse enablement pack typically contains:

- Schema information of the source data
- Additional table requirement in the data warehouse
- Specific data mart(s) to be built
- ETL processes to load data:
  - into the data warehouse
  - into the data mart(s)
- Canned reports to display data from the data mart(s)
- Required metadata that identify the product

The Tivoli Data Warehouse product has several different components. The configuration is shown in Figure 1-1 on page 4.

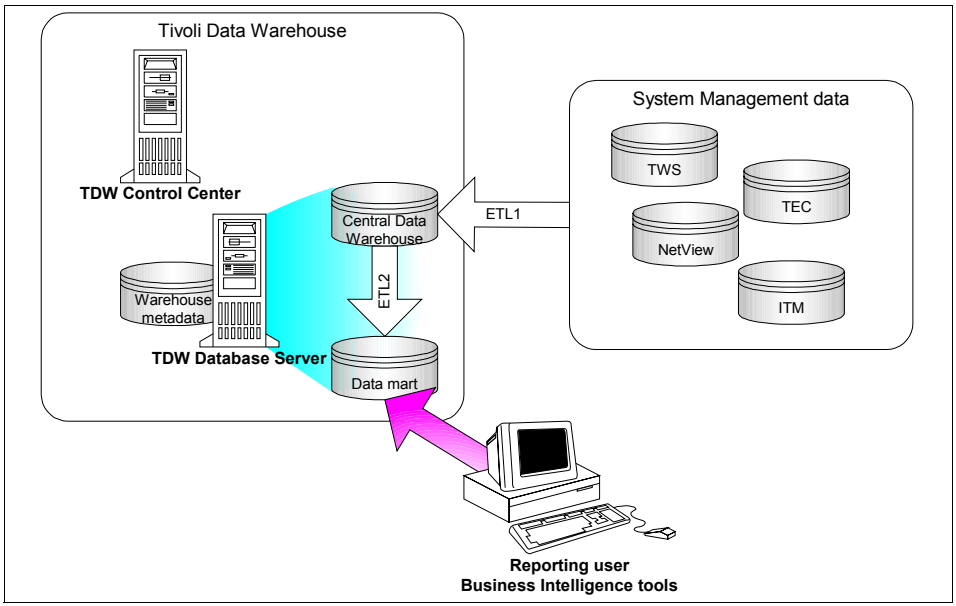

Figure 1-1 Tivoli Data Warehouse components

Figure 1-1 shows how machines can be configured using the Tivoli Data Warehouse:

- The TDW Database Server contains the DB2 Universal Database server engine and warehousing tools. The Tivoli Data Warehouse software is also installed here.
- The TDW Control Center uses the DB2 Control Center and DB2 Data Warehouse Center to provide a graphical interface to manage data collection and ETL processes. This machine runs the DB2 administration client.

Note: Another component that is not shown in the figure is the Tivoli Data Warehouse reporting server that runs a canned version of Crystal Enterprise. This is a Web server that provides reports to end users for the data in the data mart.

In Tivoli Data Warehouse, data sources are provided by the individual system management applications. These data sources are loaded into the central data warehouse using an ETL that is called ETL1 or source ETL. Data are then transferred into the data mart using an ETL that is called ETL2 or target ETL. All the information on ETL processes are stored in the control database that is managed by the control center.

The default database names are:

TWH_MD	Metadata database that contains the control information
TWH_CDW	Central data warehouse that is the master copy of all system management data
TWH_MART	Star schema database that contains the data marts for reporting purposes

For this Redpaper, we focus on the TWH_MART database.

1.3 Report generation

Reports are typically generated from star schema. Star Schema is a preferred method for reports generation. In Figure 1-2, we use sales revenue data to illustrate the concept.

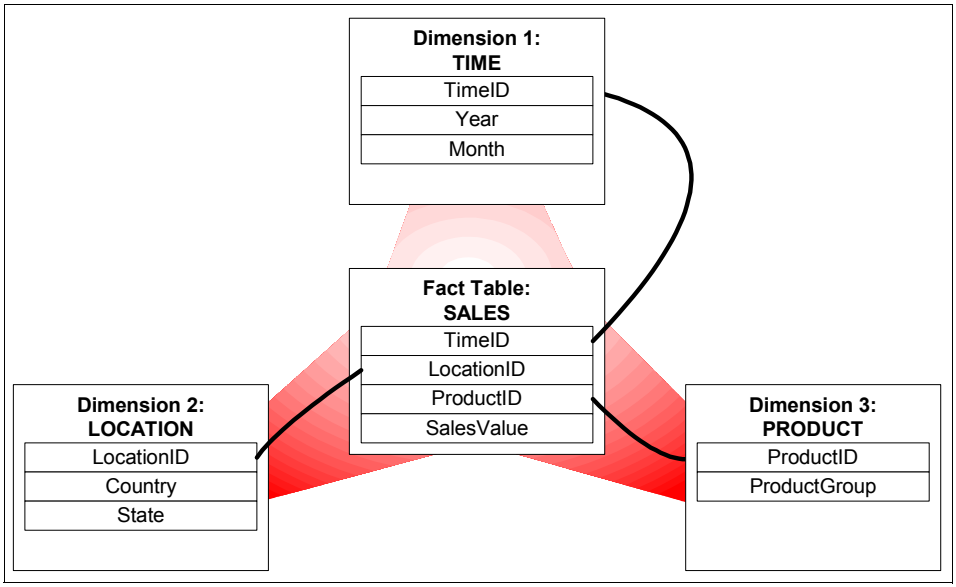

Figure 1-2 Sample star schema

The central table is the fact table. It contains the individual sales values for each time unit, location, and product. The granularity of data in the fact table depends on the granularity of the categorization hierarchy of the dimension tables. As shown in Figure 1-2, there are three dimensions of this data:

- The *time* dimension indicates the time frame in which the revenue is collected. It is configured as year, month.

- The *location* dimension indicates the geographical location where the revenue is collected. It is configured as country, state.
- The *product category* indicates the product line breakdown of the revenue. It is configured as group, brand.

Note: There can be more than two levels of hierarchy in the dimension. The illustration here only shows two levels for simplicity.

We assume that the following data are available:

- Time range: from October 2003 - March 2004
- Locations: Australia - NSW, Australia - West, U.S. - California, U.S. - Texas, U.S. - New York
- Products: Printer, Computer, Scanner

Then we can visualize the data as a cube as shown in Figure 1-3. Each box in the diagram represents a single sales revenue data element.

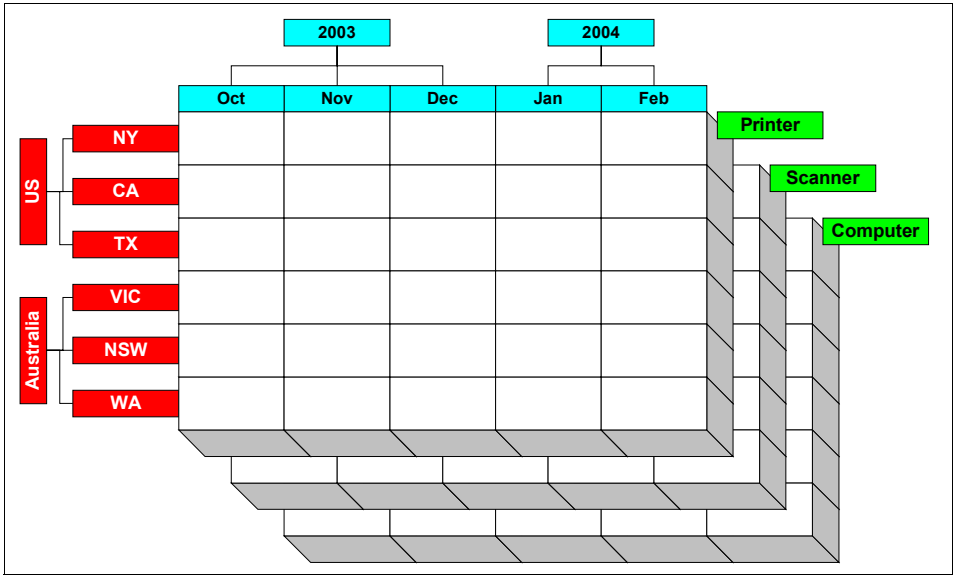

Figure 1-3 Sample cube

A sample report can be generated to retrieve the answer to a question such as: *What is the revenue by product for Australia in 2003?* The answer to this question is represented by the shaded cubes shown in Figure 1-4 on page 7.

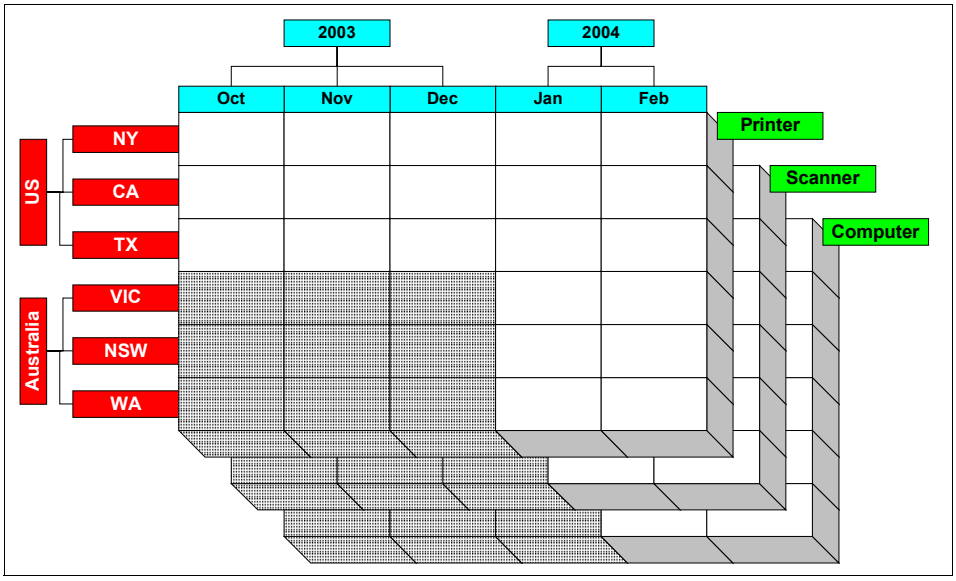

Figure 1-4 Sample cube - answer to business question

From the subset shown in Figure 1-4, we can manipulate the report in several ways to get more meaningful information. Some of the better known techniques are:

- Drill-down: breaking data down into a more detailed level such as by state or month
- Slice and dice: changing the way data is sorted and viewed for comparison purposes such as comparing computers sold in Austrailia in 2003 with revenue from the U.S. in the same year

1.4 Reporting tools

This document is divided into chapters based on the reporting tools that are explored. Chapter 2, “Business Objects” on page 9 discusses the reporting tools from Business Objects®, a leading business intelligence software company.

2

Business Objects

This chapter describes the reporting tools from the software vendor, Business Objects, for use in accessing the Tivoli Data Warehouse. Rather than focusing on the technical deployment of Business Objects' platforms and servers, this chapter focuses on the reporting capabilities of Business Objects' software products. In particular, we take you step by step through the company's Designer and BusinessObjects products to help you get started creating your own reports in the Tivoli Data Warehouse quickly and easily.

The sections in this chapter are:

- 2.1, "Business Objects overview" on page 10
- 2.2, "Business Objects business intelligence platform" on page 12
- 2.3, "Installing BusinessObjects desktop components" on page 13
- 2.4, "Configuring BusinessObjects for Tivoli" on page 14
- 2.5, "Using BusinessObjects" on page 23
- 2.6, "Advanced universes and documents" on page 32
- 2.7, "Deploying BusinessObjects" on page 34

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2.1 Business Objects overview

This section introduces Business Objects as a company, as well as its product line called BusinessObjects Enterprise 6.0.

2.1.1 Company overview

Business Objects was created in 1990. It has now more than 18,000 customers in over 80 countries. Business Objects' products and services help 86 global Fortune 100 companies to track, understand, and manage their businesses.

Business Intelligence is the technology that enables companies to leverage and transform data stored in corporate databases into business information.

2.1.2 Products

Business Objects' integrated business intelligence product suite is called BusinessObjects Enterprise 6.0. Figure 2-1 on page 10 shows BusinessObjects Enterprise 6.0 suite of products.

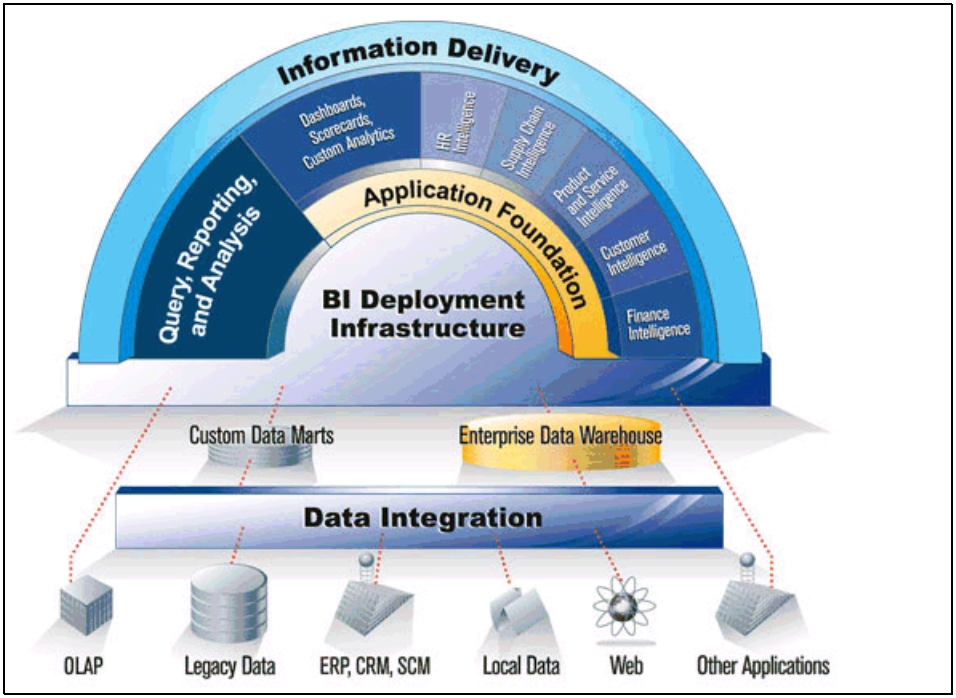


Figure 2-1 BusinessObjects Enterprise 6.0

BusinessObjects Enterprise 6.0 covers the following areas: Data Integration, Business Intelligence Platform, Query Reporting and Analysis, Analytic Applications, and Information Delivery. These areas are explained in Table 2-1.

Table 2-1 Areas covered by BusinessObjects Enterprise 6.0

Area	Description
Data Integration	Business Objects data integration products include all the features of extract, transform, and load (ETL) tools, plus bidirectional and real-time data movement, packaged data marts, and automatic Business Objects universe management.
Business Intelligence Platform	Business Objects offers all of the administration products you need to maintain optimal system performance while keeping costs down. Use the administration products to manage user activity, deploy Business Intelligence products across the enterprise, and tailor Business Intelligence solutions to fit evolving user needs. Do all of this from a centralized security and administration system supported by the integrated BusinessObjects Enterprise 6.0 platform, lightening the workload on the IT department.
Query Reporting and Analysis	BusinessObjects Enterprise 6.0 makes it easy for companies to quickly and efficiently track, understand, and manage the wealth of knowledge stored in multiple data sources. Using the integrated query, reporting, and analysis products, you can access the information you need, analyze it, and share standardized reports across the enterprise--and beyond.
Analytic Applications	Enterprise analytic applications provide tools to help an organization make more intelligent decisions. As an integrated part of the new BusinessObjects Enterprise 6.0 product suite, the analytic applications let you easily implement and customize prepackaged analytics and use a data warehouse to manage disparate data sources.
Information Delivery	Enterprise 6.0 provides a complete solution for information delivery to serve the needs of the extended enterprise. You can intelligently disseminate business intelligence (Business Intelligence) across the enterprise and beyond with information tailored to individual users. And with cost-effective and reliable Business Intelligence distribution, internal and external users can track, understand, and manage enterprise performance.

In this Redpaper, we discuss some of the elements of the Business Intelligence platform, the Query Reporting and Analysis, and Information Delivery areas. In 2.2, “Business Objects business intelligence platform” on page 12, we describe those elements that will enable us to quickly access, analyze and share information contained in a Tivoli Data Warehouse.

2.2 Business Objects business intelligence platform

This section provides an overview of the BusinessObjects Enterprise 6.0 suite that enables companies to easily access, analyze and share information stored in a Tivoli Data Warehouse.

2.2.1 Desktop components

The desktop components are meant to be installed on a Windows® 2000 operating system. Here are the three main desktop components.

- BusinessObjects

  BusinessObjects is an integrated query, reporting and analysis solution that allows you to access data in your corporate databases directly from your desktop. It will help you present and analyze this information in a BusinessObjects document.

- Designer

  The Designer allows a user from the IT department to create the business layer that enables end-users to access databases without knowing standard query language (SQL). This is a business layer called a universe. The Designer helps IT people build a universe, maximizing the usage of database resources while ensuring that correct results will be generated.

- Supervisor

  The Supervisor administers the repository. It allows the administrator to create users, arrange them in groups, and give them access rights on data or product features.

2.2.2 Server components

The server components are commonly installed on server machines, running Windows Operating System or IBM @server® pSeries® server machines. This Redpaper does not discuss these server components in detail. Here are two common server components.

- WebIntelligence

  WebIntelligence provides users with a Web-based Business Intelligence portal called Infoview. From infoview, users can access and refresh BusinessObjects documents. In addition to that, infoview users can create new documents using a lightweight, easy-to-use interface called the Web Query Panel.

- Broadcast Agent

Broadcast Agent allows BusinessObjects and WebIntelligence users to publish their documents through the repository and schedule the execution of those documents, as well as their distribution to a large number of users.

2.3 Installing BusinessObjects desktop components

In this section, we tell you how to install the desktop components: BusinessObjects, Designer and Supervisor. For installing the server components, refer to the *installation and deployment guide* on the installation CD.

2.3.1 Prerequisites

Before starting the installation of BusinessObjects Enterprise 6.0 software, make sure you have the following:

- Windows 2000 workstation, with at least 128 MB memory
- A licence key file

  The license key is a file with a suffix of .signed.key.xml. It contains necessary information to let you install and run the products on your computer.
- The installation CDs or files

2.3.2 Installation procedure

Once you have all the prerequisites, you are ready to install BusinessObjects desktop products.

1. On the installation CD, start the setup.exe program. The BusinessObjects Enterprise 6.0 installation Wizard is displayed.
2. Click **Next**. Read the license agreement.
3. Select **I accept the terms**, and click **Next**. The software and hardware requirements are displayed.
4. Click **Next**. The license files folder window appears. In order to install correctly, the setup wizard needs to read your license key file. Click the **Change** button and find the directory in which you have stored the license key file. You can check the validity of your license key file by clicking the **Check License** button. Figure 2-2 on page 14 shows the License files window.

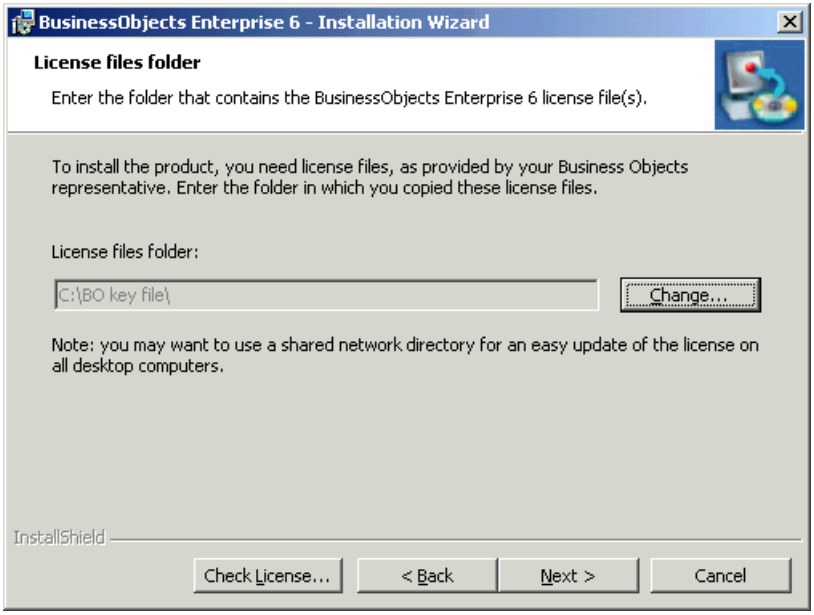

BusinessObjects Enterprise 6 - Installation Wizard
License files folder
Enter the folder that contains the BusinessObjects Enterprise 6 license file(s).
To install the product, you need license files, as provided by your Business Objects representative. Enter the folder in which you copied these license files.
License files folder:
C:\BO key file\
Change...
Note: you may want to use a shared network directory for an easy update of the license on all desktop computers.
InstallShield
Check License...
< Back
Next >
Cancel

Figure 2-2 Selecting the license key file directory during setup

5. Click **Next**. Choose a User name and Organization (this is for registration only).
6. Click **Next**. Choose **Desktop installation** and click **Next**. You are now ready to install Desktop products.
7. Click **Next** to start copying files. The installation process is then complete.

2.4 Configuring BusinessObjects for Tivoli

In this section, we will use Designer Version 6.0 and BusinessObjects Version 6.0 to show a simple integration scenario with Tivoli Enterprise™ Data Warehouse. We also cover setting up the integration and running reports.

We first installed Designer Version 6.0 and BusinessObjects Version 6.0 onto a Windows 2000 workstation as explained in 2.3, “Installing BusinessObjects desktop components” on page 13.

We installed DB2 Client software on the same machine. The Tivoli Data Warehouse database with the reporting data is typically called TWH_MART. The DB2 client has been configured for connecting to the TWH_MART database.

For using the Tivoli Data Warehouse database, we need to configure BusinessObjects by creating a universe. A universe is a business or semantic layer that insulates end-users from the complexity of the database. In this section, we are going to go through several steps to build the universe:

1. Starting Designer
2. Creating a new universe
3. Importing tables
4. Creating joins between tables
5. Creating classes
6. Creating objects
7. Renaming and arranging objects
8. Creating measure objects
9. Creating a time hierarchy

Let's go through each of these steps in detail.

2.4.1 Starting Designer

Let's start working with the Designer.

1. From the Windows desktop, use **Start** -> **Programs** -> **BusinessObjects 6.0** -> **Designer**. If you have set up a repository, you will have to log on using a user name and password.
2. The quick design wizard window appears. Click **Cancel**, since we will create a universe manually, in order to review all the steps in detail.

2.4.2 Creating a new universe

We will now create a new universe.

1. From the menu, choose **File** -> **New**.
2. The Universe Parameters window appears. Type a name for your new universe, for example `TWH_MART`.
3. Now, tell Designer how to access the Tivoli database. To do this, create a new connection. Under the connection textbox, click **Create**.
4. Select **IBM DB2 Client** and click **OK**. The IBM DB2 Client connection window appears.
   - Type a new name for the connection, such as `Connection to TWH_MART`.
   - Select the **DB2 UDB V7** from the database engine drop-down menu.

– Enter a DB2 user name and password and select the DB2 name of the TWH_MART database connection from the data source name drop-down menu.

Note: The data source name is using the ODBC system data source. If the TWH_MART database is not in the drop-down list, it means that it has not been configured for ODBC. You need to configure it first, using the DB2 Client Configuration Assistant.

Figure 2-3 shows the DB2 connection window.

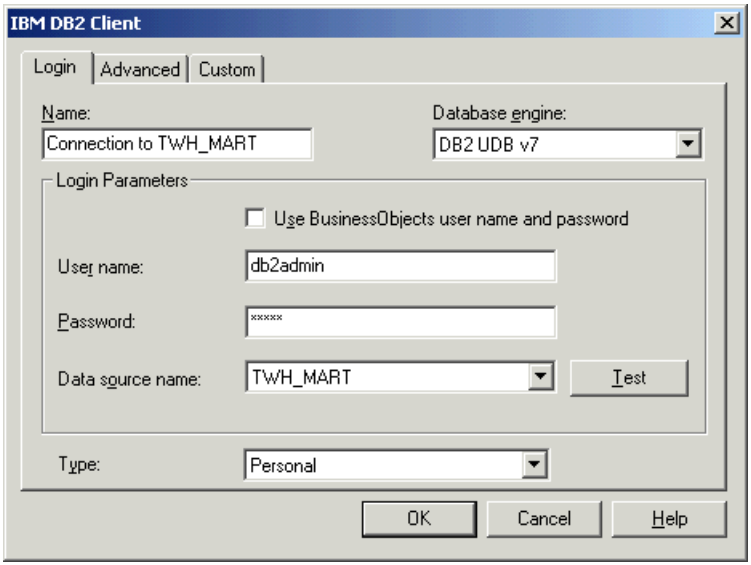


Figure 2-3 Connection parameters window described in Step 4

5. Click **OK**. You are back to the Universe Parameters window as shown in Figure 2-4 on page 17. You can now type a description for the universe, such as `This is a universe to access and analyze data stored in the Tivoli Data Warehouse`. Then click **OK** to start working on it.

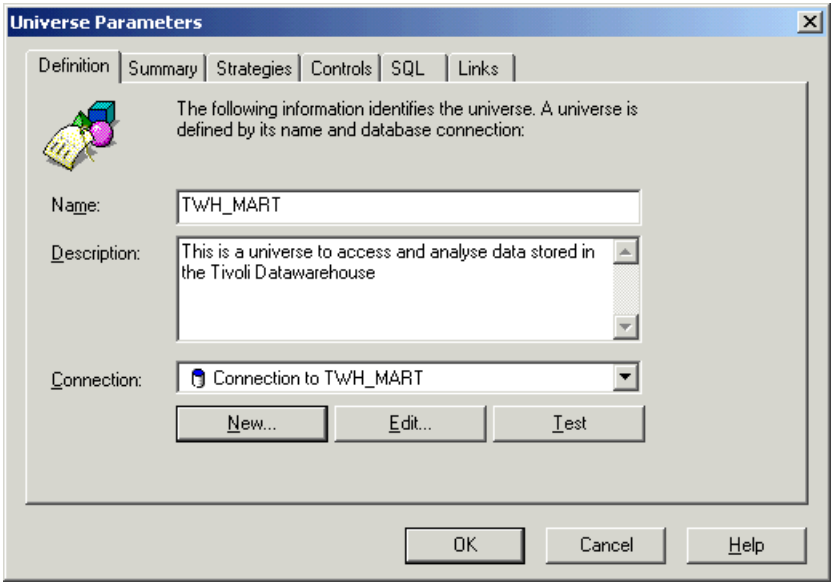


Figure 2-4 The universe parameters window in Step 5

2.4.3 Importing tables

We are now ready to import tables in the universe. To do so, simply double-click in the center of the displayed window. The table browser appears, as shown in Figure 2-5 on page 18. In the Tivoli Data Warehouse, each component has a different table creator. In this example, we will use the AMY component, which contains data from IBM Tivoli Monitoring for Operating Systems.

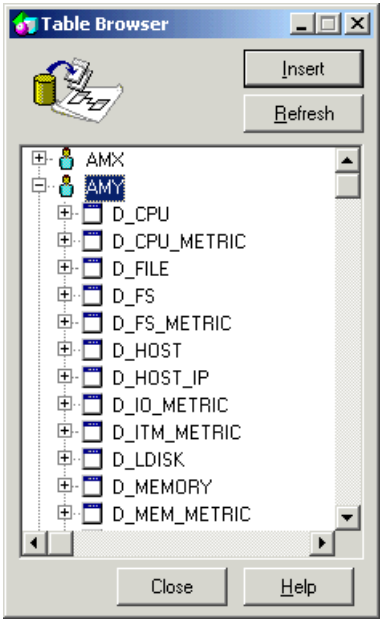


Figure 2-5 The table browser

1. In the AMY tablespace, find the D_HOST table, drag and drop it on the center window.
2. Do the same for the tables F_CPU_HOUR and D_CPU_METRIC. As seen on Figure 2-6, you now have three tables in your universe. You can close the table browser now.

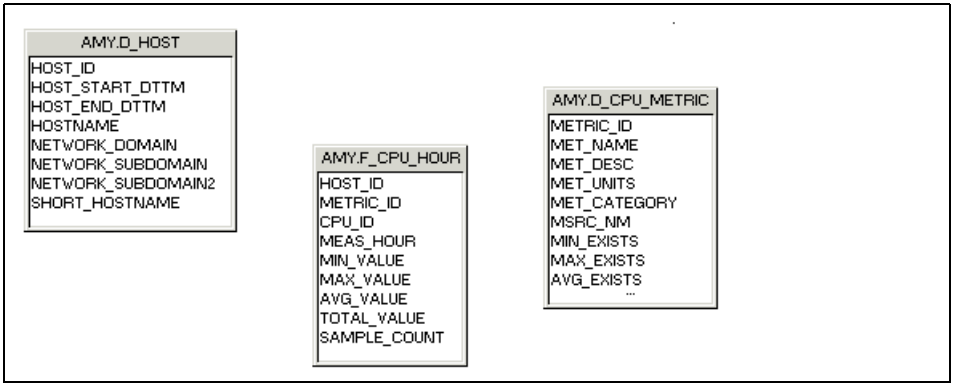


Figure 2-6 The center window after three tables are imported

We have imported the D_HOST table, which is a dimension table. Each line contains a particular host's attributes. The D_CPU_METRIC table is another

dimension table. Each line describes a particular metric related to CPU operation. The F_CPU_HOUR is a fact table at the hour level. Each line gives the value of a particular metric for a particular host and time.

2.4.4 Creating joins between tables

The tables in the universe need to be joined together so that BusinessObjects understand the relationship between these tables. To create simple joins, follow the steps below:

1. Click the HOST_ID field of the AMY.D_HOST table, hold the mouse button down, and drag it all the way to the HOST_ID field in the AMY.F_CPU_HOUR table.
2. Do the same from the METRIC_ID field in the AMY.F_CPU_HOUR table to the METRIC_ID field in the AMY.F_CPU_HOUR table. As seen in Figure 2-7, you now have three tables with two joins.

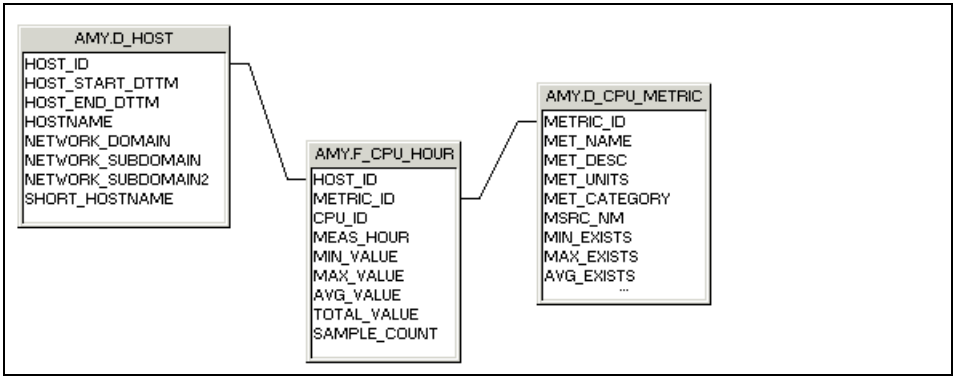


Figure 2-7 Three tables and two joins in the center window

2.4.5 Creating classes

Once the tables and joins are created, we need to organize the way end-users access them. The end user does not need to know anything about databases, tables, joins, and SQL. All the end user will see is a set of objects arranged into classes. To make things easy for the end user, we will create three classes:

1. From the menu, choose **Insert** -> **Class**. Give this first class the name `Host`.
2. Create two other classes named `Metric`, and `Measures`.
3. The left pane of your screen should now look similar to Figure 2-8 on page 20.

Figure 2-8 The universe as it is now: three empty classes

2.4.6 Creating objects

In BusinessObjects, there are three different types of objects:

Dimension Dimension objects are used to define the context in which we observe a particular measure. Dimension objects can be arranged in hierarchies. For example, a geographical hierarchy can be comprised of the following dimensions: country, state, city, household.

Information Information objects are attached to dimension objects and give further details about them. For example, we could attach a Household object to its street address.

Measure Measures are numeric objects that are aggregated using an aggregate function such as Min, Max, or Sum.

We will now add a few objects to our universe. The end user will be able to select any combination of them to formulate a query.

1. From the AMY.D_HOST table, pull the NETWORK_DOMAIN field, and drop it into the Host class in the left pane.
2. From the AMY.D_HOST table, pull the HOSTNAME field, and drop it into the Host class in the left pane.
3. From the AMY.D_CPU_METRIC table, pull the MET_CATEGORY field, and drop it into the Metric class in the left pane.
4. From the AMY.D_CPU_METRIC table, pull the MET_NAME field, and drop it into the Metric class in the left pane.
5. From the AMY.D_CPU_METRIC table, pull the MET_DESC field, and drop it into the Metric class in the left pane.
6. From the AMY.F_CPU_HOUR table, pull the MIN_VALUE field, and drop it into the Measure class in the left pane.
7. From the AMY.F_CPU_HOUR table, pull the MAX_VALUE field, and drop it into the Measure class in the left pane.
8. From the AMY.F_CPU_HOUR table, pull the AVG_VALUE field, and drop it into the Measure class in the left pane.

Your universe should now resemble Figure 2-9.

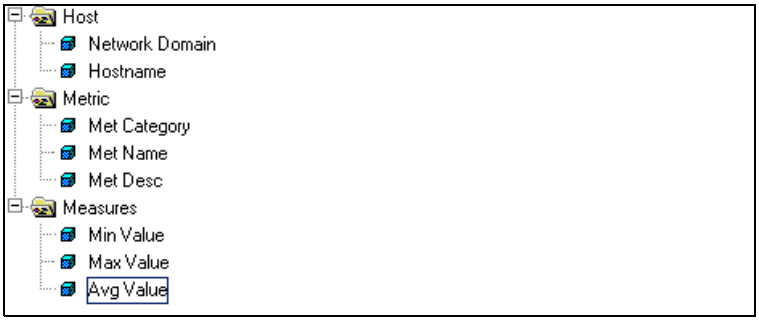


Figure 2-9 Universe with three classes and eight objects

2.4.7 Renaming and arranging objects

We can rename objects so that it is simpler for users to read and browse the universe. To do so, simply double-click an object on the left pane, this will show the object's properties. Type a new name and a description that the user will see while browsing the universe. Rename a few objects so that your universe now resembles Figure 2-10.

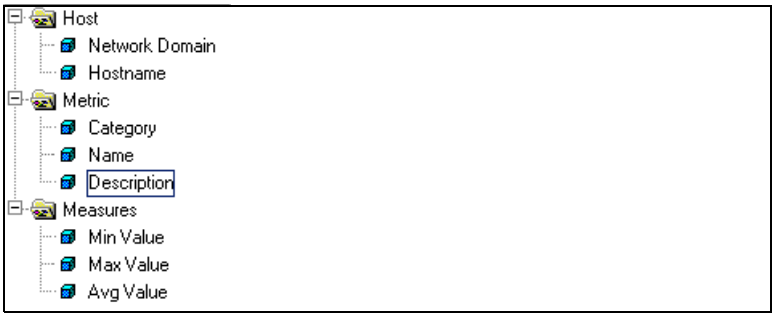


Figure 2-10 Universe after the metric class objects have been renamed

In the Metric class, an object called Description exists. It is not a dimension per say. This means that we will not aggregate measures according to description, but rather according to detailed information concerning a specific metric from Tivoli. Let's transform this object into a detail object:

1. Double-click the Description object. The Object Properties window appears.
2. Go to the second tab named **Properties**. From there, select **Detail** in the Qualification options.
3. In the associated dimension drop-down, choose the **Nam**e object.

4. Close this window by clicking **OK**. The universe now resembles Figure 2-11

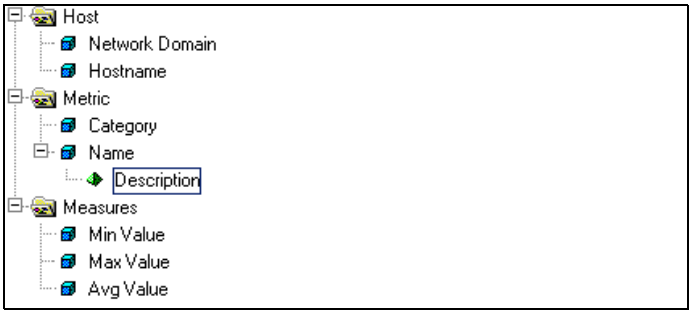


Figure 2-11 A green pyramid represents an Information object

2.4.8 Creating measure objects

Now we need to create measure objects. We already have three objects in the Measures class. Let's transform them into measures:

1. Double-click the **Min Value** object. The Object Properties window appears. You will find a *Select* window where the *Select* part of the SQL statement is shown. Default values will display. In some cases, you may want to type a more complex *Select* statement involving several tables.
2. Go to the **Properties** tab. Choose **Measure** in the Qualification options.
3. Choose the **Min Aggregate Function**.
4. Repeat for the **Max Value** and **Avg Value** objects, using the corresponding aggregate function in the properties tab.

Your universe now resembles Figure 2-12.

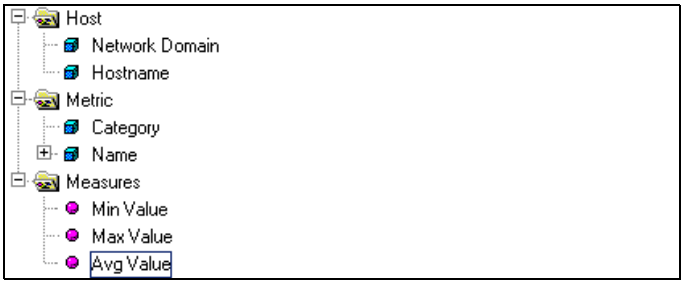


Figure 2-12 Our universe with three dimensions (red bullets)

2.4.9 Creating a time hierarchy

We are almost done. We will now create a time hierarchy.

1. Create an additional class (from the Menu, choose **Insert** -> **Class**), and name it **Time**.
2. Pull the MEAS_HOUR column from the F_CPU_HOUR table into the new class.
3. Double-click the newly created object. Give it a new name: **Time**.
4. Go to the Properties tab, and click the **Automatic Time Hierarchy** button. Check the **Year** and **Month** options. This will create two additional dimensions, computed from the MEAS_HOUR column, using DB2 SQL formulas.
5. Close both the **Time Hierarchy** and **Object Properties** window. Your universe now resembles Figure 2-13.

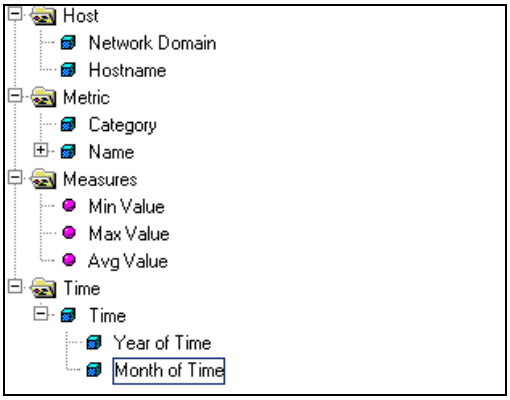


Figure 2-13 Complete universe

We are now ready to use this universe.

2.5 Using BusinessObjects

We have successfully created a universe using the Designer. The universe is what the end-user will use to create queries. We will now use BusinessObjects to create a report based on Tivoli Data Warehouse data.

In this section, we describe several ways of creating and using BusinessObjects reporting tools. The discussion will consists of the following topics:

- 2.5.1, “Creating a simple report” on page 24

- 2.5.2, “Executing the query and answering the prompts” on page 27
- 2.5.3, “Manipulating the report” on page 28

2.5.1 Creating a simple report

Follow these steps to create a simple query:

1. To start BusinessObjects, go to the Windows start menu, choose **Start** -> **Programs** -> **Business Objects** -> **BusinessObjects 6.0**.
2. If you are using a repository, you will be prompted for a user name and password.
3. Once started, BusinessObjects will show the New Report Wizard. Choose **Generate a standard report**, and click **Begin**.
4. Now, we will choose how to access data. The most common way to access data is to use a universe. Other ways include accessing a personal data file, such as an Excel spreadsheet, or a flat file. In the New Report Wizard, choose **Universe**, and click **Next**. A dialog window similar to the one in Figure 2-14 is displayed.

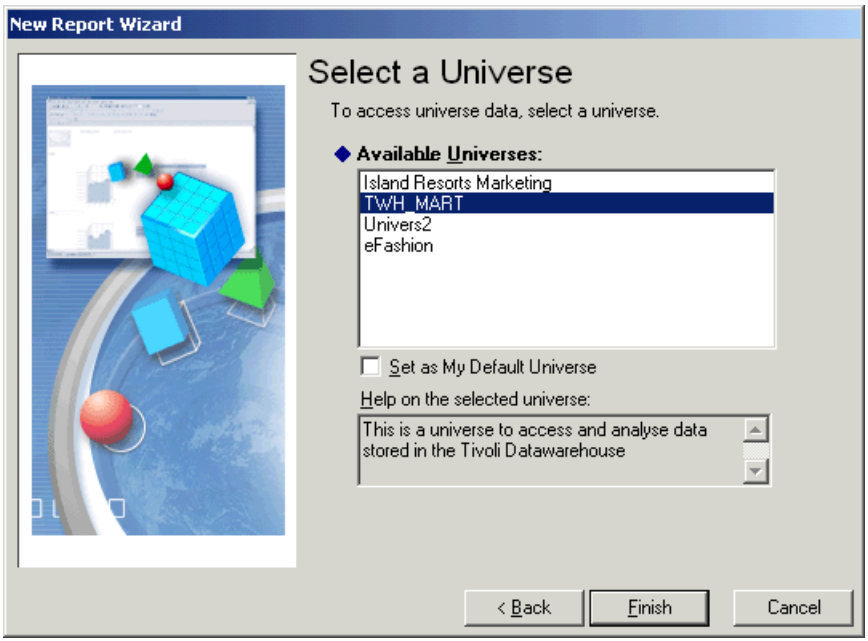


Figure 2-14 Choosing a universe in the New Report Wizard

5. Choose the TWH_MART universe that we have just created in 2.4, “Configuring BusinessObjects for Tivoli” on page 14, and click **Finish**. The query panel then appears, as shown in Figure 2-15.

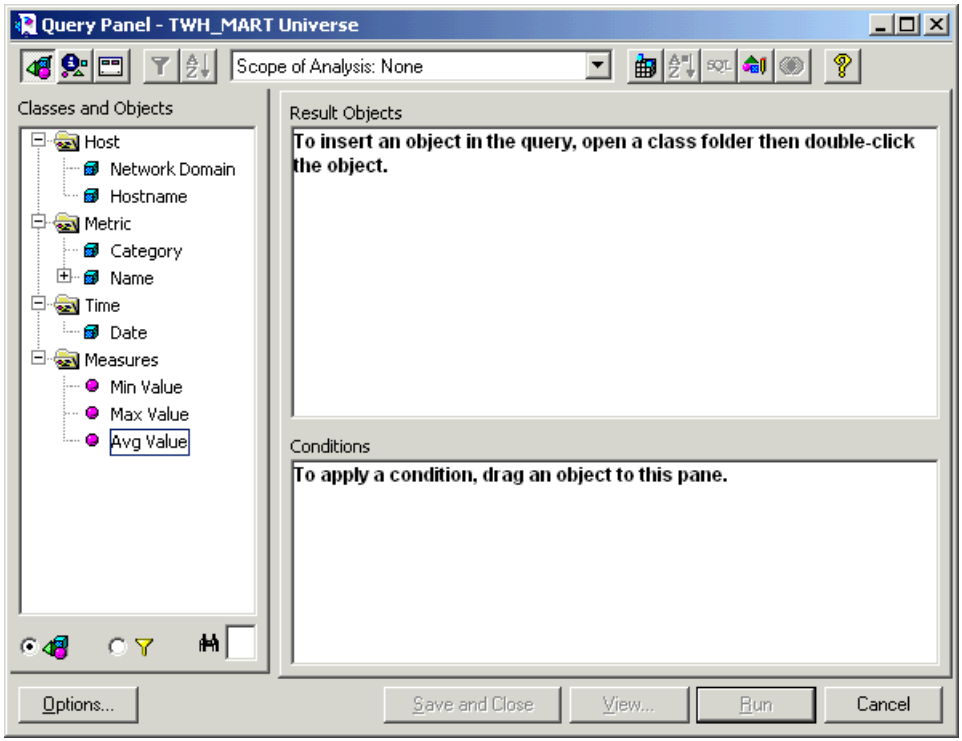


Figure 2-15 The query panel showing our TWH_MART universe

There are three main areas in the query panel window in Figure 2-15. The left part shows the universe that we have designed with Designer. It has objects arranged into classes. The top right part is the result pane, where we will put the objects we want to use in our query. The bottom right part shows the conditions applied to this query.

6. Let’s open the different classes of the universe and double-click the following objects:
   - In the Metric class, the dimension called **Name**
   - In the Time class, the dimension called **Time**
   - In the Measures class, the three measure objects called **Min Value**, **Max Value** and **Avg Value**.

That is all you need to do to formulate a query. This query will retrieve the data associated with the dimension and measure objects that you double-clicked.

7. Now let's add a condition to this query. Every time this report is run, we want the user to specify which hostname he wants to analyze. Pull the Hostname object under the Host class, and drop it in the condition window at the bottom right of the query panel.
8. From the list of functions on the left, double-click **Equal To**. Still on the left side, choose **Type a new prompt**. This means that we will type a question that is going to pop up every time the report is refreshed.
9. In the text box that appears next to the Hostname object, type `Which host?` in the condition window. Click **OK**.
10. You are done. Your query panel should now resemble the one in Figure 1-26:

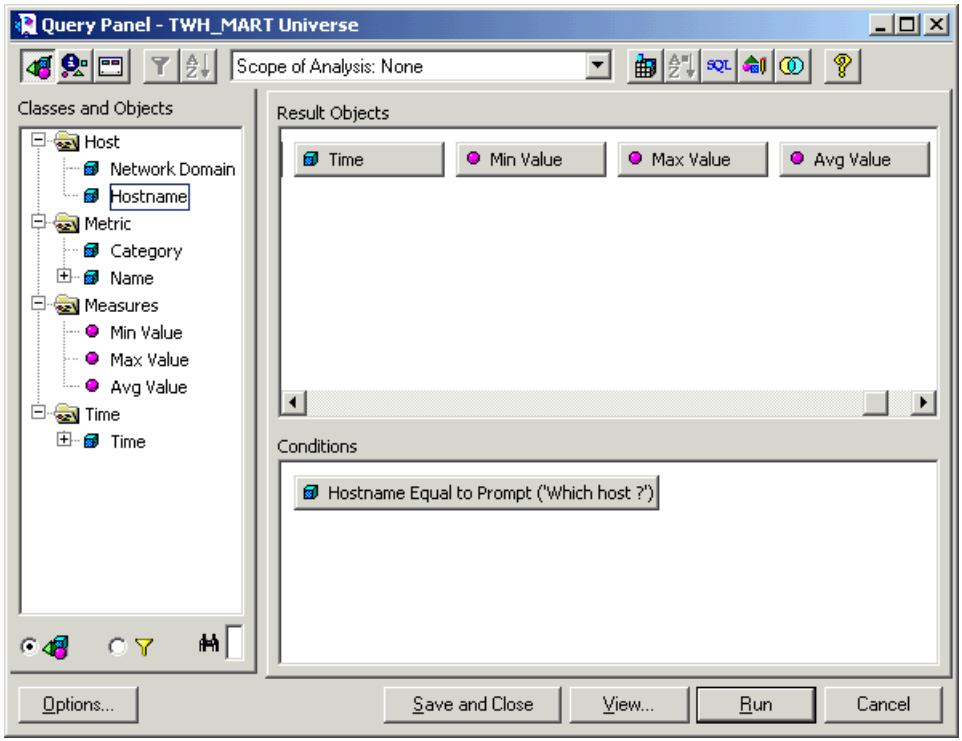


Figure 2-16 The query panel, ready to run

2.5.2 Executing the query and answering the prompts

We can now execute the query by clicking the **Run** button. Because we set up a condition with a prompt, BusinessObjects will ask you the question shown in Figure 2-17.

Figure 2-17 The prompt window

From here, you can either type a value for the hostname, or use the **Values** button on the right. Choose or type a hostname. In this example, we will use tdw010 as the hostname.

Click the **OK** button to execute the query.

Now BusinessObjects connects to the TWH_MART database from the Tivoli Data Warehouse and executes an SQL statement to retrieve the data we asked for. The result displays as a default table as shown in Figure 2-18 on page 28.

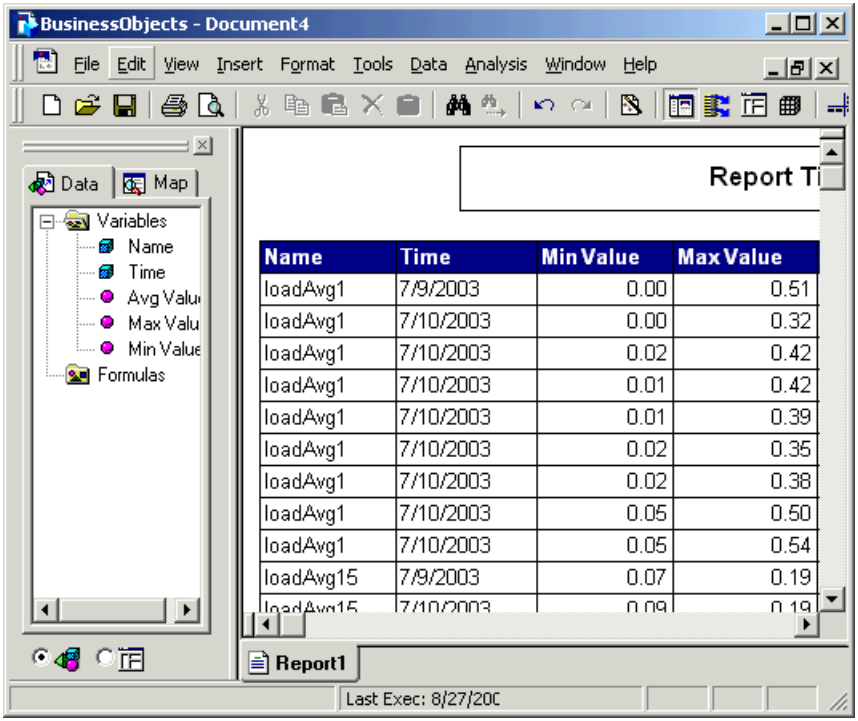


Figure 2-18 BusinessObjects showing results in a standard table

2.5.3 Manipulating the report

There are several things that you can do with the BusinessObjects report. The following sub-sections shows these manipulations. These are the things that we will do:

- “Modifying the title” on page 28
- “Creating a section” on page 29
- “Adding avg, min and max values in each table” on page 29
- “Creating a graph” on page 30
- “Refreshing a report” on page 32

Modifying the title

Double-click the **Report Title** cell and type a new title such as `CPU Measures Analysis`. This will help other users of this report understand what it is about.

Creating a section

At the present time, we have a single and long table. Let's break it into several tables, one for each metric name. To do so,

1. Right-click any value in the Name column. The column values are then displayed in reverse video, and a contextual menu appears.
2. In the contextual menu, choose **Set as master**.

We now have the dimension Name set as a section, and we have a table containing the time object along with three measures in each section.

Adding avg, min and max values in each table

Now add a bottom line to each table.

1. Right-click any of the values in the Min Value column. The column displays in reverse video and a contextual menu appears.
2. In the contextual menu, choose **Calculations** -> **Minimum**.

   The summary line is then added. There are several ways to add cells to a table. Let's now add the maximum on the bottom line, using BusinessObjects formulas.
3. To display the formula bar, choose in the menu **View** -> **Toolbars**, then add the Formulas Toolbar.
4. Select the cell in the bottom line of your table in the Max Value column. The cell is highlighted and your table should resemble the one in Figure 2-19.

Time	Min Value	Max Value	Avg Value
7/9/2003	0.00	0.51	0.14
7/10/2003	0.00	0.32	0.11
7/10/2003	0.02	0.42	0.18
7/10/2003	0.01	0.42	0.13
7/10/2003	0.01	0.39	0.17
7/10/2003	0.02	0.35	0.15
7/10/2003	0.02	0.38	0.19
7/10/2003	0.05	0.50	0.22
7/10/2003	0.05	0.54	0.24
Minimum:	**0.00**		

Figure 2-19 Selecting a cell in a table. Note that sections are not shown in this figure

5. Now, in the formula toolbar, type the following formula:

   ```
   =Max( <Max Value> )
   ```

   The formula is automatically evaluated in each table, depending on the context.

6. Do the same operation for the cell in the bottom line and in the Avg Value column, with the following formula:

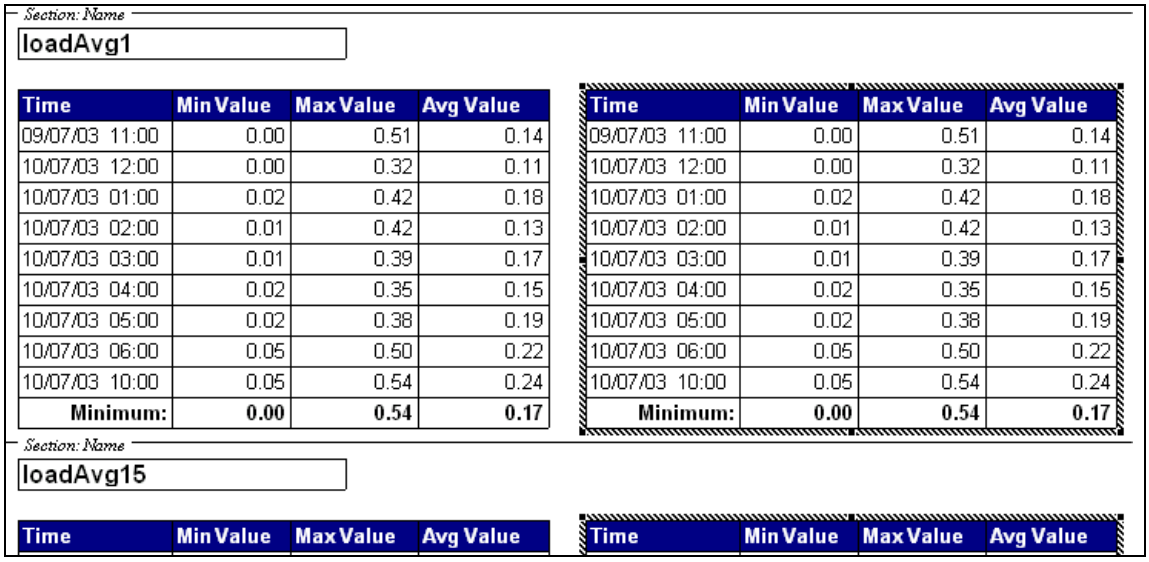
   ```
   =Average( <Avg Value> )
   ```

Note: In the formulas above, we have indicated which aggregation function to use (min, average, etc.). It is not compulsory to indicate an aggregation function when one has been defined in the universe, like we did for the <Min Value>, <Max Value> and <Avg Value> measure objects. The aggregation function in the universe is used at the query time (against the database), as well as in the report if none is specified.

Creating a graph

We now have a complete table. Let's duplicate it to create a graph. To do so:

1. Select the table by clicking its edge. A cross arrow mouse pointer appears when you can select a table.
2. Press the **Ctrl** key and drag the table to the right.
3. Drop the table. You should now have two tables in each section as shown in Figure 2-20 on page 31.


Section: Name

loadAvg1

Time	Min Value	Max Value	Avg Value
09/07/03 11:00	0.00	0.51	0.14
10/07/03 12:00	0.00	0.32	0.11
10/07/03 01:00	0.02	0.42	0.18
10/07/03 02:00	0.01	0.42	0.13
10/07/03 03:00	0.01	0.39	0.17
10/07/03 04:00	0.02	0.35	0.15
10/07/03 05:00	0.02	0.38	0.19
10/07/03 06:00	0.05	0.50	0.22
10/07/03 10:00	0.05	0.54	0.24
Minimum:	**0.00**	**0.54**	**0.17**

Time	Min Value	Max Value	Avg Value
09/07/03 11:00	0.00	0.51	0.14
10/07/03 12:00	0.00	0.32	0.11
10/07/03 01:00	0.02	0.42	0.18
10/07/03 02:00	0.01	0.42	0.13
10/07/03 03:00	0.01	0.39	0.17
10/07/03 04:00	0.02	0.35	0.15
10/07/03 05:00	0.02	0.38	0.19
10/07/03 06:00	0.05	0.50	0.22
10/07/03 10:00	0.05	0.54	0.24
Minimum:	**0.00**	**0.54**	**0.17**

Section: Name

loadAvg15

Time	Min Value	Max Value	Avg Value

Time	Min Value	Max Value	Avg Value

Figure 2-20 View of our document after the table has been duplicated

Now let's transform this second table into a graph:

1. Bring up the Report toolbar if it is not showing.
2. Select the table on the right by clicking its edge.
3. In the report toolbar, use the Chart Type drop down, and choose **2D Line**.

We now have both a table and a graph showing the CPU measures. If you notice, the graph scale is probably from 0 to 100, for all sections. To adapt the scale in each section, do the following:

1. Right-click the chart. A contextual menu appears. Choose **Format Chart**.
2. In the Chart Format window, go to the first tab called General and check the option at the bottom right called **Adjust Scale to Value Range**.
3. Click **OK**. Your graph now shows an adaptive scale.

From here, you can do additional formatting by right-clicking on each element of the graph, and choosing **Format Data Series**, or **Format Legend**, depending on where you clicked.

Refreshing a report

Note that our report can be re-executed, this operation is called a refresh. To refresh the document,

1. Choose **Data** -> **Refresh Data** from the menu. The prompt that we have defined in the query is then displayed.
2. Choose another host from the list of values, then click the **OK** button.
3. The query executes and the document is updated as shown in Figure 2-21.

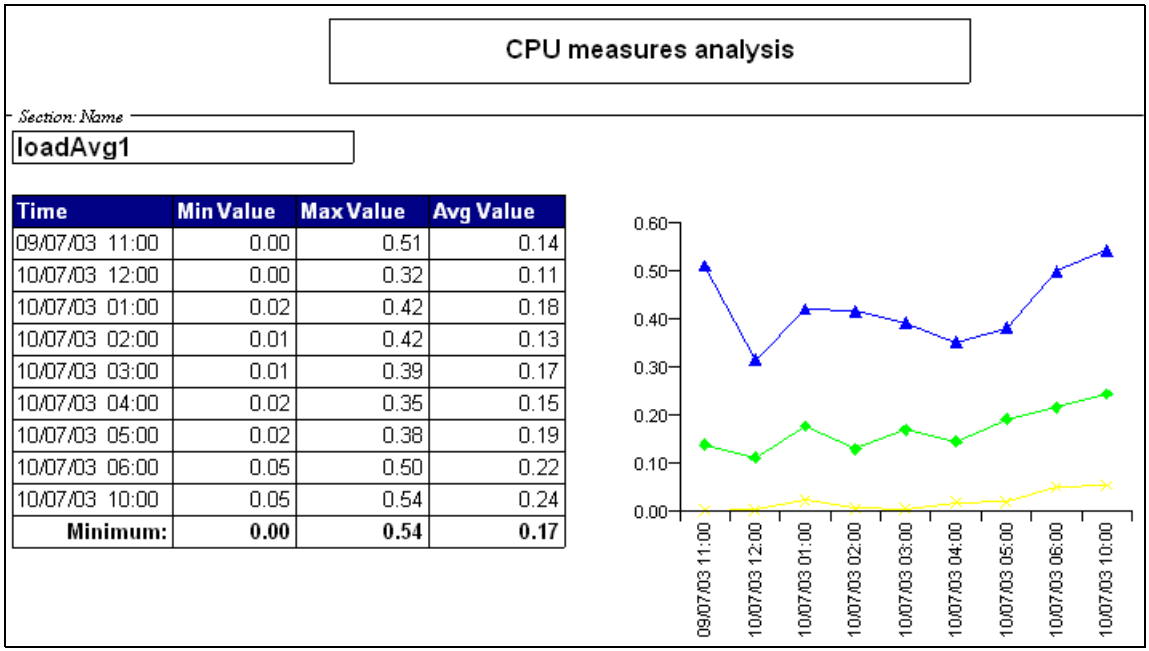


Figure 2-21 Our document as it looks at the end of this tutorial

2.6 Advanced universes and documents

This section briefly describes the main concepts involved in real-life design and uses of universes and documents. The discussion refers you to the Designer, Supervisor, and BusinessObjects.

2.6.1 Advanced universe design

A production universe will typically contain between 30 and 200 objects, involving multiple dimensions and fact tables. It provides hierarchies for the user to drill down to more detailed information.

The universes should be designed so that given any combination of objects chosen by the user, the SQL generated will be correct. In particular, the universe should avoid SQL traps such as loops, chasms, and fans.

To help the IT people design a proper universe, the Designer proposes additional facilities that will not be discussed in details here. Read the *Designer user manual.* It has chapters dedicated to these topics. The additional concepts in Designer are:

Alias In Designer, an alias refers to a physical table. For example, the physical table *country* is used both to store a customer's home country, as well as the company's facility's country. In order to use the country table as a customer's country and facility's country, we'll create an alias of that physical table to be used by each function.

Context A context is defined by the universe author. It is a group of joins that are allowable in a single SQL statement. Contexts are typically used to resolve loops in your schema.

Hierarchy A hierarchy is an ordered list of dimension objects. It allows the end user to navigate data in a top down fashion. The location dimension can have a hierarchy of country, state, city, and ZIP code.

Strategy In Designer terminology, a strategy is a set of rules that enable you to automatically import or create tables, joins and objects in a universe. A typical strategy will do most of the job of importing metadata from another environment such as an ETL or other data warehousing tool.

2.6.2 Advanced reporting with BusinessObjects

BusinessObjects answers the needs of both the casual user as well as the expert production report designer.

You might be interested in some of the following features of BusinessObjects.

Multiple data sources BusinessObjects allows you to create as many data providers as you need. A data provider may be built on a universe, on a personal data file such as an Excel spreadsheet, or an XML file. BusinessObjects allows you to synchronize multiple sources and use them jointly in a single block (table, cross-table, graph, and so on).

Conditional reporting Conditional reporting is the ability to show or hide an element of your report based on the result of a formula.

Alerters Alerters help you call attention to some data by formatting it differently. This could be used to highlight a particular condition that has been met, for example.

2.6.3 Security and deployment with Supervisor

The supervisor will let you administer the repository. See 2.7, “Deploying BusinessObjects” on page 34, for additional information on repositories. The supervisor enables you to:

- Manage the BOMain.key file for identifying the repository.
- Create users and arrange them into groups. Several levels of groups are allowed.
- Give users or groups access to documents and universes.
- Define row-level security on the data. As an example, the western region sales managers should only see the western region sales figures.
- Grant users or groups access to each of the different tools features. As an example, a particular user may not be able to print, or save their documents locally.
- Manage decentralized repositories.

2.7 Deploying BusinessObjects

This section introduces the tools needed to deploy BusinessObjects to a workgroup or larger number of users.

2.7.1 The repository

The repository is the cornerstone of a BusinessObjects deployment. It is flexible enough to enable workgroup deployments as well as company wide deployments.

The repository is a database composed of a little more than 50 tables. It is used to store user definitions, universes, and documents. These three pieces are also called the security domain, the universe domain, and the document domain. The diagram of the repository is shown in Figure 2-22 on page 35.

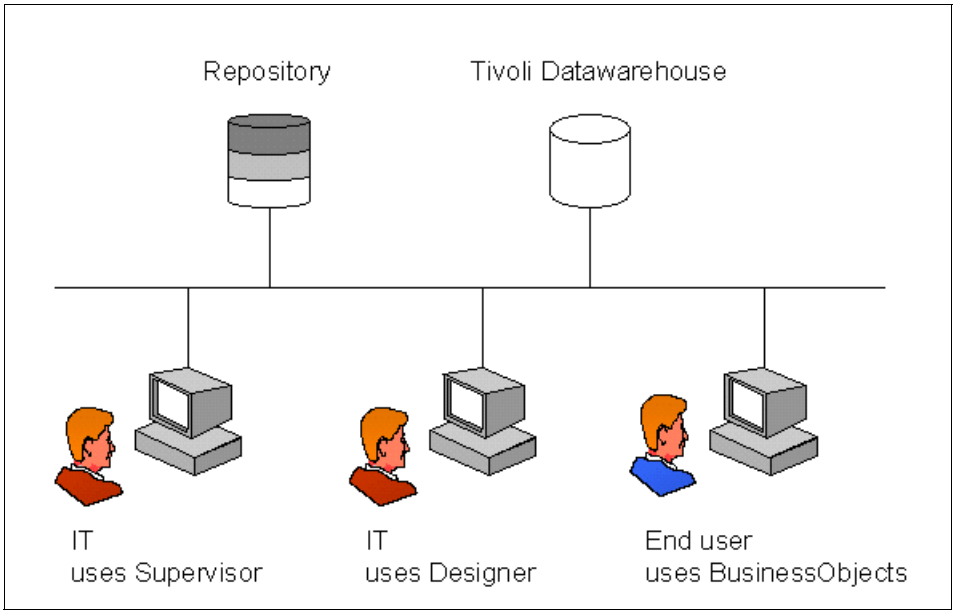


Figure 2-22 Simple architecture diagram

The Supervisor tool creates the repository. It can be stored on a separate database engine. The definition of the connection to the Tivoli Data Warehouse can then be stored in the repository as a secured connection, so that several end users can use it.

The BOMain.key file

The BOMain.key file lets BusinessObjects components know where the repository is stored. This BOMain.key file is created by the supervisor at the end of the repository creation process. You can also create a new BOMain.key file on an existing repository, using Supervisor's safe recovery admin feature.

Sharing universes and documents through the repository

Once a repository has been set up, users can access it using the BOMain.key file. Each user (according to the rights they have been granted in Supervisor), will then be able to publish universes and documents in the repository. By default, publishing universes and documents lets other users of their group have access to them.

Instead of publishing a document to his whole group, a user can choose to send it to a particular user.

Decentralized repositories

It is possible to attach several universe domains and several document domains to a single security domain. This is useful for both development and production environments as well as for decentralized organizations.

Read the *Supervisor user manual* for further information on how to deploy such configurations.

2.7.2 Deploying to Web users

Once you have created a repository, you can deploy universes and BusinessObjects documents to Web users. To do so, you need to install WebIntelligence on a server machine.

WebIntelligence uses a BOMain.key file to retrieve documents from a repository and serves the documents to Web users through a Web-based Business Intelligence portal. The portal name is Infoview.

2.7.3 Deploying documents to large number of users

To deploy documents to a large number of users, you can simply publish them to the repository. All authorized users having access to the repository will be able to retrieve documents.

However, each user may want to have a personal view of a document. As an example, a regional sales manager wants to receive sales figures for his region only, every Monday morning. Without a Broadcast agent, this user will retrieve the document from the repository, and then refresh it. BusinessObjects then queries the Data Warehouse to retrieve sales data.

If every regional sales manager does the same operation on Monday morning, the Data Warehouse will receive a considerable workload to handle.

Broadcast Agent for optimizing document deployment

Using Broadcast Agent Scheduler, the task of performing the refresh of the same document for several recipients is programmable, during weekends for example, so that each recipient receives a personalized view of a document. This is called report bursting.

Broadcasting through e-mail or Web

In addition to the Broadcast Agent Scheduler, you can add the Publisher Web and Publisher Mail function. Once a report has been bursted, the resulting sales document can then be published to the Web or sent by e-mail to a very large number of users (tens of thousands).

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Tivoli Data Warehouse 1.2 and BusinessObjects

Advanced reporting capability for Tivoli Data Warehouse

Complete installation and usage examples

Covers BusinessObjects

This IBM Redpaper will guide you on using various reporting tools that are available in the market to work with the data you collect with Tivoli Data Warehouse. The collected data resides on a DB2 database with the form or star schema. The basic Tivoli Data Warehouse product comes with an integrated reporting tool. However, the reports provided with the product may not be sufficient for all your reporting needs. You may want to use vendor reporting tools to expand the reporting capability of the Tivoli Data Warehouse.

This Redpaper discusses the reporting tools of the software vendor, Business Objects, that can be used to access and mine the data stored in the Tivoli Data Warehouse.

The discussion of each vendor reporting tool should not be considered a replacement for its respective vendor product manual. The examples provided in this Redpaper serve as a quick reference for you to start using the reporting tools contained in BusinessObjects™ Enterprise Suite 6.0.

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